

Contamination Analyzer

Environment and Resources Management

Below is the Sievers Model 800 Total Organic Carbon (TOC) Analyzer, manufactured by Sievers Instruments, Inc. and based on technology originally developed for use on the International Space Station. The company describes the analyzer as the "ideal solution for on-line organics measurement in any stage of water purification, from feedwater to ultrapure process water."

Measurement of the total organic carbon content of water is a widely used method of assessing the level of contamination caused by organic compounds. TOC measurement is important in high purity waters used in power generation, pharmaceutical production and electronics manufacture: the presence of even trace levels of organic compounds can cause defects in manufactured products or corrosion in power generation equipment. TOC analysis is similarly important in determining contaminant levels in industrial and municipal wastewater.

In the analytical methods used on Earth for more than 30 years, organic compounds in a water sample are completely oxidized to form carbon dioxide, the amount of which is measured. The standard technique for TOC measurement involves bubbling a compressed gas into the water to purge the carbon dioxide formed by the oxidation step, and a large infrared detection system for measuring the amount of carbon dioxide purged, which requires daily calibration. This method was not suitable for space sta-

tion use. To monitor closed-loop water recycling systems in orbit, NASA sought a small, compact TOC analyzer with gravity-independent components, one that would employ minimal use of chemical reagents and would not require frequent calibration or maintenance.

Sievers Instruments worked with McDonnell Douglas Space Systems Company on a NASA-funded project that led to development of a new technique for TOC measurement, in which a strong chemical oxidizing agent and ultraviolet light are used to convert the organic compounds to carbon dioxide. The carbon dioxide passes from the water sample through a membrane and into a stream of deionized water, where it becomes ionized; the amount of ions is determined by measuring the conductivity of the deionized water. The new technique is highly sensitive, requires calibration only once a year, does not require compressed gas to purge the carbon dioxide from the sample, and is capable of operating in microgravity.

This technology has been commercialized in the Sievers Model 800 TOC Analyzer. Introduced to the market in 1993, the instrument is being used to monitor organic contaminants in electric power generation, pharmaceutical production, biotechnology, semiconductor manufacturing and other industrial/environmental applications. The low maintenance feature required for the space system has been included in the commercial instrument; the only maintenance required is quarterly replacement of the chemical reagents.

